

CLAIMS

Applicant confirms that claims 1-127 were canceled before entering the U.S. national phase.

128. (previously added) An aerial launch and recovery system for an aircraft, said system comprising:

a lifting apparatus for carrying said aircraft to an elevated altitude,
a tow line connecting said lifting apparatus to a base structure,
launching means, and
arrestment means;

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said lifting apparatus being aurally deployed from said base structure, said launching means being adapted to carry said aircraft to said elevated altitude and release said aircraft for flight mode, said arrestment means being adapted to capture and retain said aircraft from mid-air flight, said tow line enabling said lifting apparatus and said captured aircraft to be pulled back to said base structure.

129. (currently amended) ~~An~~ In combination, an aircraft capable of controlled flight and an aerial launch system for ~~an~~ said aircraft, said system comprising:

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a lifting apparatus for carrying said aircraft to an elevated altitude,
a tow line connecting said lifting apparatus to a base structure, and
launching means,

said launching means being adapted to carry said aircraft to said elevated altitude and release said aircraft for flight mode.

130. (currently amended) ~~The aerial launch system of claim 129,~~ An aerial launch system for an aircraft, said system comprising:

_____ a lifting apparatus for carrying said aircraft to an elevated altitude,

_____ a tow line connecting said lifting apparatus to a base structure, and

_____ launching means,

said launching means being adapted to carry said aircraft to said elevated altitude and release said aircraft for flight mode, said base structure comprising a transportable conveyance comprising a water craft capable of creating a relative wind through forward movement sufficient to provide lift to said lifting apparatus.

Claim 131 previously canceled without prejudice.

132. (previously added) The aerial launch system of claim 129 in which a winch is provided to facilitate aerial deployment and recovery of said tow line, said winch enabling said lifting apparatus to be maintained at variable altitudes.

133. (currently amended) An aerial launch system for an aircraft, said system comprising:

_____ a lifting apparatus for carrying said aircraft to an elevated altitude,

_____ a tow line connecting said lifting apparatus to a base structure, and

_____ launching means,

said launching means being adapted to carry said aircraft to said elevated altitude and release said aircraft for flight mode, in which a winch is provided to facilitate aerial deployment and recovery of said tow line, said winch enabling said lifting apparatus to be maintained at variable altitudes and ~~The aerial launch~~

~~system of claim 132 in which~~ pulleys are provided for varying the point of deployment of said tow line from said base structure.

Claims 134-136 previously canceled without prejudice.

Claims 137-138 canceled without prejudice.

Claim 139 previously canceled without prejudice.

Claim 140 canceled without prejudice.

141. (currently amended) An aerial recovery system for an aircraft, said system comprising:

a lifting apparatus for carrying said recovery system to an elevated altitude,

a tow line connecting said aerial apparatus to a base structure, and

arrestment means;

said lifting apparatus being aurally deployed from said base structure, said arrestment means being adapted to capture and retain said aircraft from mid-air flight, said tow line enabling said lifting apparatus and said captured aircraft to be pulled back to said base structure ~~The aerial recovery system of claim 137 in which said lifting apparatus is a lighter-than-air balloon in combination within a parasail with a lifting device requiring a relative wind to generate lift.~~

Claims 142-146 canceled without prejudice.

147. (currently amended) The aerial recovery system of claim ~~137~~ 150 in which a ~~camera~~ sensor is attached to said recovery system near the point of engagement of said aircraft to said recovery system, ~~said camera pointing in the~~

~~direction of said incoming aircraft so as to detect said aircraft~~ for guidance in maneuvering said aircraft into engagement with said recovery system.

Claims 148 and 149 canceled without prejudice.

150. (currently amended) An aerial recovery system for an aircraft, said system comprising;

an arrestment line held up at at least one end,

said aircraft containing a device for capturing said line,

said aircraft containing structure suitable for deflecting said line laterally into engagement with said capturing device, said structure being selected from the group consisting of an aircraft wing and structure attached to an aircraft wing.

151. (previously amended) The aerial recovery system of claim 150 where said line is held up by a lifting apparatus.

152. (previously added) The aerial recovery system of claim 150 where said capturing device is a hook.

153. (currently amended) The aerial recovery system of claim ~~150~~ 152 where said hook has a line retaining device.

Claims 154-156 previously canceled without prejudice.

157. (previously added) The aerial recovery system of claim 150 in which said capturing device is positioned on a forward inboard edge of a wing of said aircraft.

Claim 158 previously canceled without prejudice.

159. (currently amended) The aerial recovery system of claim 150 in which a propeller guard deflects said arrestment line away from ~~the~~ a propeller of said aircraft.

Claims 160-167 previously canceled without prejudice.

168. (currently amended) An aerial recovery system for an aircraft, said system comprising:

_____ a lifting apparatus for carrying said recovery system to an elevated altitude,

_____ a tow line connecting said aerial apparatus to a base structure, and

_____ arrestment means;

said lifting apparatus being aially deployed from said base structure, said arrestment means being adapted to capture and retain said aircraft from mid-air flight, said tow line enabling said lifting apparatus and said captured aircraft to be pulled back to said base structure. ~~The aerial recovery system of claim 137 in which there is an engagement point on the recovery system for contact and capture of said aircraft, a suspension line supported by said lifting apparatus in turn supports said engagement point, and a mechanism is provided to retract said suspension line in order to raise said engagement point and said aircraft.~~

Claims 169-174 previously canceled without prejudice.

Claims 175-176 canceled without prejudice.

177. (currently amended) The recovery system of claim ~~476~~ 257 where ~~said structure is~~ arrestment line is held up by a beam, the beam comprising a boom.

Claims 178-183 canceled without prejudice.

184. (previously amended) An aerial recovery system for an aircraft, said system comprising:

a net, a draw string that passes around the periphery of said net and is slidably attached at points around the periphery of said net, a support system sufficient to carry the weight of the net and the aircraft, said draw string is connected to said support system and said draw string is suitable for pulling the periphery of the net together around the back of said aircraft to encapsulate said aircraft during arrestment.

185. (previously added) An aerial recovery system for an aircraft, said system comprising: an aerial apparatus for carrying said recovery system to an elevated altitude, a net to capture said aircraft, said net has at least three attach points spaced around the periphery of said net, lines attached to each of said net attach points extend up to support said net and aircraft from said aerial apparatus, the load on said lines during and after arrestment holds the net around said aircraft to help retain said aircraft.

Claim 186 previously canceled without prejudice.

187. (currently amended) An aerial recovery system, said system comprising: an aircraft, a net suspended below a support system, said support system capable of holding the weight of the net and aircraft, a hook on said aircraft positioned so as to engage a line in said net during engagement and prevent said aircraft from passing through said net during contact of said aircraft

with said net, and structure that allows said line to engage said hook but prevents said line from backing away from said aircraft.

Claims 188-195 previously canceled without prejudice.

Claims 196-197 canceled without prejudice.

198. (currently amended) A method for recovering an aircraft, said method comprising steps of:

deploying a lifting apparatus to an elevated altitude,

connecting a lifting apparatus to a base structure by a tow line, and

maneuvering said aircraft into an arrestment means while in flight ~~The method for recovering an aircraft of claim 196 in which said maneuvered aircraft is adapted to engage said recovery system~~ arrestment means while flying a ~~non-coincident~~ flight path other than a level flight path in a vertical plane defined by said tow line.

Claims 199-208 previously canceled without prejudice.

209. (previously added) The aerial recovery system of claim 150 in which said structure is swept aft to reliably deflect said arrestment line to said capturing device.

210. (previously added) The aerial recovery system of claim 209 in which said structure is swept aft 5 degrees or more to reliably deflect said arrestment line to said capturing device.

211. (previously added) The aerial recovery system of claim 209 in which said structure is swept aft 10 degrees or more to reliably deflect said arrestment line to said capturing device.

212. (previously added) The aerial recovery system of claim 150 in which the leading edge of said structure sweeps aft to reliably deflect said arrestment line to said capturing device.

213. (previously added) The aerial recovery system of claim 212 in which the leading edge of said structure sweeps aft more than 5 degrees to reliably deflect said arrestment line to said capturing device.

214. (previously added) The aerial recovery system of claim 212 in which the leading edge of said structure sweeps aft more than 10 degrees to reliably deflect said arrestment line to said capturing device.

Claim 215 canceled without prejudice.

216. (previously added) The aerial recovery system of claim 150 in which the capturing device is located inboard of the aircraft's wingtip.

217. (previously added) The aerial recovery system of claim 216 in which the capturing device is located inboard more than 5% of the wing semi-span.

Claims 218 and 219 canceled without prejudice.

220. (previously added) The aerial recovery system of claim 150 in which multiple generally vertically oriented arrestment lines are spaced apart across the direction of travel of said aircraft as it approaches for recovery so as to increase the lateral capture envelope of said recovery system.

221. (previously added) The aerial recovery system of claim 150 in which said capturing device is located generally over the center of gravity of the

vehicle when the wings are level so that the aircraft is held in a level attitude after arrestment.

Claim 222 canceled without prejudice.

223. (previously added) The method for stowing and deploying of the aerial lifting apparatus of claim 129 in which said lifting apparatus has riser lines that extend up to a fabric canopy and a winch is used to retract and extend said tow line and riser lines onto a drum of said winch.

224. (previously added) The method for recovering an aircraft of claim 150 in which said line is deflected inboard relative to the aircraft.

225. (previously added) The aerial launch system of claim 130 in which said lifting apparatus is a parasail, parafoil or other deployable fabric lifting system.

226. (previously added) The aerial recovery system of claim 150 in which said system is designed to rotate said aircraft to a generally wings level position and hold said aircraft in said wings level position.

227. (previously added) The aerial recovery system of claim 150 in which said line is supported in the air by a rotor.

228. (previously added) The aerial recovery system of claim 150 in which said line is held up by a boom that can rotate about a generally vertical axis.

229. (previously added) The aerial recovery system of claim 150 in which said line is supported in the air by another line strung generally horizontally between two supports.

230. (previously added) The aerial recovery system of claim 150 in which said line is supported in the air by an aircraft.

231. (currently amended) A method for capturing a flying object, comprising the steps of:

a) suspending ~~one or more~~ a linear or curvilinear ~~fixture(s)~~ fixture across the flight path of the object in a generally vertical orientation, or otherwise in an orientation which includes a component normal to the flight path;

b) guiding the object to strike ~~one or more of the fixture(s)~~ the fixture;

c) allowing the subsequent motion of the object to slide the ~~fixture(s)~~ fixture along a wing or spanwise lifting surface of the flying object;

d) intercepting the sliding of the ~~fixture(s)~~ fixture by one or more hooks attached to a wing or spanwise lifting surface of the flying object;

e) decelerating the flying object under the restraint of the ~~fixture(s)~~ fixture; and

f) removing the flying object from the ~~fixture(s)~~ fixture.

232. (currently amended) In combination, a flying object and an apparatus for capturing a the flying object, the combination comprising:

a) ~~one or more~~ a linear or curvilinear ~~fixture(s)~~ fixture suspended across the flight path of the object in a generally vertical orientation, or otherwise in an orientation which includes a component normal to the flight path;

b) means for suspending the ~~fixture(s)~~ fixture; and

c) means attached to the flying object for intercepting the sliding of the ~~fixture(s)~~ fixture along a wing or spanwise lifting surface of the flying object.

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233. (currently amended) The apparatus combination of claim 232, wherein the linear or curvilinear fixture is a cable.

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234. (currently amended) The apparatus combination of claim 232, wherein the means for suspending the ~~fixture(s)~~ fixture is selected from the group consisting of a kite, a balloon, a kite/balloon hybrid, an aircraft, a mast, and a crane.

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235. (currently amended) The apparatus combination of claim 232, wherein the means for intercepting the sliding of the ~~fixture(s)~~ fixture comprises at least one hook on a wing or spanwise surface of the flying object.

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236. (currently amended) The apparatus combination of claim 232, wherein each hook includes a cleat or latch such that after the fixture is intercepted by the hook, sliding of the fixture through the hook is substantially arrested.

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237. (currently amended) The apparatus combination of claim 232, wherein the motion of the flying object during deceleration is accommodated by compliance of the ~~fixture(s)~~ fixture.

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238. (currently amended) A method for capturing a flying object, comprising the steps of:

a) suspending ~~one or more linear or curvilinear fixture(s)~~ a fixture across the flight path of the object in a generally vertical orientation, or otherwise in an orientation which includes a component normal to the flight path, such that the suspension of the ~~fixture(s)~~ fixture is kept clear of said flight path by a distance greater than the height or width of said flying object;

- b) guiding the object to strike ~~one or more of the fixture(s)~~ said fixture;
 - c) intercepting the ~~fixture(s)~~ fixture by one or more hooks attached to a wing or spanwise lifting surface of the flying object;
 - d) decelerating the flying object under the restraint of the ~~fixture(s)~~ fixture;
- and
- e) removing the flying object from the ~~fixture(s)~~ fixture.

239. (currently amended) In combination, a flying object and an An
apparatus for capturing a the flying object, the combination comprising:

- a) means for suspending one or more ~~linear or curvilinear fixture(s)~~ across the flight path of the object in a generally vertical orientation, or otherwise in an orientation which includes a component normal to the flight path, such that the suspension of the ~~fixture(s)~~ fixture is kept clear of said flight path by a distance greater than the height or width of said flying object;
- b) means for suspending the ~~fixture(s)~~ fixture; and
- c) means attached to a wing or spanwise lifting surface of the flying object for intercepting the ~~fixture(s)~~ fixture.

240. (currently amended) The ~~apparatus~~ combination of claim 239,
wherein the ~~linear or curvilinear~~ fixture is a cable.

241. (currently amended) The ~~apparatus~~ combination of claim 239,
wherein the means for suspending the ~~fixture(s)~~ fixture is selected from the group consisting of a kite, a balloon, a kite/balloon hybrid, an aircraft, a mast, and a crane.

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Tucker 242. (currently amended) The apparatus combination of claim 239,

wherein the means for intercepting the ~~fixture(s)~~ fixture comprises at least one hook on a wing or spanwise surface of the flying object.

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Tucker 243. (currently amended) The apparatus combination of claim 239,

wherein each hook includes a cleat or latch such that after the fixture is intercepted by the hook, sliding of the fixture through the hook is substantially arrested.

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Tucker 244. (currently amended) The apparatus combination of claim 239,

wherein the motion of the flying object during deceleration is accommodated by compliance of the ~~fixture(s)~~ fixture.

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Tucker 245. (previously added) The method of claim 238 with the additional

step between steps d) and e) of quickly taking out the slack in the fixture.

✓102 Tucker 246. (previously added) The method of claim 245 in which the slack in

the fixture is taken out by a device that pulls on the fixture.

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Tucker 247. (currently amended) The apparatus combination of claim 239

additionally including a device to rapidly take out the slack in the fixture after engagement of said aircraft to said fixture.

248. (currently amended) The apparatus combination of claim 247

where said device is located further down the flight path of said flying object than the suspension point of said fixture.

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Tucker 249. (previously added) The method of claim 238 in which the loads

from decelerating the flying object are reduced by a mechanism for increasing the displacement of the fixture.

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250. (currently amended) The apparatus combination of claim 239 additionally including one or more stops or local enlargements of the fixture to assist in preventing said aircraft from sliding down said fixture.

Please add the following claims 251-291:

251. (new - formerly claim 115) A method for launching and recovering an unmanned aircraft, said method comprising steps of:

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lifting said aircraft to an elevated altitude by means of a lifting apparatus, connecting said lifting apparatus to a base structure by a tow line, launching said aircraft at said elevated altitude, and maneuvering said aircraft into arrestment means while in flight.

252. (new) In combination, an aircraft, said aircraft comprising a sensor, and an aerial launch system for said aircraft, said system comprising:

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a lifting apparatus for carrying said aircraft to an elevated altitude, a tow line connecting said lifting apparatus to a base structure, and launching means,

said launching means being adapted to carry said aircraft to said elevated altitude and release said aircraft for flight mode.

253. (new) An aerial recovery system for a heavier-than-air aircraft, said system comprising,

the aircraft; and

an arrestment line held up at at least one end,

said aircraft comprising a capturing device for capturing said line and structure suitable for deflecting said line laterally into engagement with said capturing device.

254. (new) The aerial recovery system of claim 187 wherein said support system is an aerial lifting apparatus.

255. (new) The aerial recovery system of claim 187 wherein said structure is a latch.

256. (new) The aerial recovery system of claim 187 wherein said structure penetrates through a hole in said net during engagement but engages one or more lines in said net to prevent said aircraft from backing away from said net after engagement.


257. (new) The recovery system of claim 150 wherein the arrestment line is held up by a device selected from the group consisting of a balloon, an aircraft, a lifting device requiring a relative wind to generate lift, and a beam.

258. (new) The recovery system of claim 150 wherein said structure is a wing and wherein said wing is swept.


259. (new) The recovery system of claim 258 wherein said wing is swept forward.

260. (new) The recovery system of claim 150 wherein said structure includes a leading edge swept aft at least fifteen degrees.

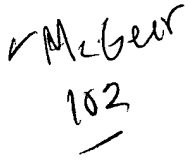
261. (new) The recovery system of claim 150 wherein said structure includes a leading edge swept forward at least twenty degrees.

 262. (new) The aerial recovery system of claim 253 wherein said capturing device is located generally over the center of gravity of the vehicle when the wings are level so that the aircraft is held in a level attitude after arrestment.

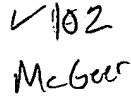
263. (new) In combination, a flying object and an apparatus for capturing the flying object,

 the flying object having a spanwise lifting surface with a capture device, the flying object being adapted for flying along a flight path,

the apparatus comprising:

 a generally linear or curvilinear fixture positionable in the flight path of the flying object, at least a portion of the fixture being inclined at an angle relative to the spanwise lifting surface to intersect the spanwise lifting surface, the fixture having an engaging surface positioned to engage the capture device of the flying object to releasably secure the flying object to the fixture; and

a support structure coupled to the fixture and positioned to support the fixture in the flight path.

 264. (new) The combination of claim 263 wherein the fixture includes a cable or pole.

265. (new) The combination of claim 263 wherein the support structure includes a lifting device requiring a relative wind to generate lift, a balloon, an aircraft, and a beam.

266. (new) The combination of claim 263 wherein the capture device comprises at least one hook on the spanwise lifting surface of the flying object.

267. (new) The combination of claim 266 wherein the at least one hook includes a latch.

268. (new) The combination of claim 267 wherein the fixture includes a cable or pole and wherein the support structure includes a lifting device requiring a relative wind to generate lift, a balloon, an aircraft, or a beam.

269. (new) The combination of claim 266 wherein the fixture includes a cable or pole and wherein the support structure includes a lifting device requiring a relative wind to generate lift, a balloon, an aircraft, or a beam.

270. (new) A method for capturing a flying object comprising:

- allowing a spanwise lifting surface of a flying object to strike a fixture positioned at an angle relative to the spanwise lifting surface while imparting a decelerating force to the flying object;
- releasably engaging the fixture with a capture device on the flying object; and
- retrieving the flying object.

271. (new) The method of claim 270 further comprising sliding at least one of the spanwise lifting surface and the fixture relative to the other while the fixture contacts the spanwise lifting surface.

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272. (new) The method of claim 270 further comprising selecting the fixture to include at least one of a cable and a pole.

273. (new) The method of claim 270 wherein positioning the fixture comprises suspending the fixture from at least one of a lifting device requiring a relative wind to generate lift, a balloon, an aircraft, and a beam.

274. (new) The method of claim 273 further comprising selecting the fixture to include at least one of a cable and a pole, and wherein releasably engaging the fixture with the capture device comprises engaging the fixture with at least one hook on a surface of the flying object.

275. (new) The method of claim 274 further comprising selecting the at least one hook to include a latch.

276. (new) The method of claim 270 wherein releasably engaging the fixture with capture device comprises engaging the fixture with at least one hook on a surface of the flying object.

277. (new) The method of claim 270 further comprising orienting the fixture at an angle approximately normal to the spanwise lifting surface.

278. (new) The method of claim 270 wherein the fixture is operatively coupled to a floating object, and wherein the method further comprises bringing the flying object aboard the floating object.

279. (new) The method of claim 270 wherein the lifting surface of the flying object is selected to be swept.

280. (new) The method of claim 270 wherein a forward edge of the lifting surface is swept forward or back by at least fifteen degrees.

281. (new) A method for capturing a flying object comprising:

positioning a fixture in a flight path of the flying object such that the fixture is inclined at an angle relative to a spanwise lifting surface of the flying object;

allowing a lateral deflecting structure of the flying object to strike the fixture while imparting a decelerating force to the flying object, the lateral deflecting structure being attached to a wing of the flying object and having at least a 15 degree swept back or 20 degree swept forward angle;

releasably engaging the fixture with a capture device on the flying object; and

retrieving the flying object.

282. (new) The method of claim 281 wherein the lateral deflecting structure is a lead edge of the wing.

283. (new) In combination:

a flying object comprising a wing, a lateral deflecting structure attached to the wing, the lateral deflecting structure having at least a 15 degree swept back or 20 degree swept forward angle, and a capture device adjacent the lateral deflecting structure, and

a fixture positionable in a flight path of the flying object such that the fixture is inclined at an angle relative to the lateral deflecting structure of the flying object.

284. (new) In combination:

a flying object comprising a spanwise lifting surface, a lateral deflecting structure attached to the spanwise lifting surface, and a capture device adjacent the lateral deflecting structure, and

a fixture positionable in a flight path of the flying object such that the fixture is inclined at an angle relative to the lateral deflecting structure of the flying object to permit the fixture to intercept the deflecting structure and to permit the deflecting structure to guide the capture device into connection with the fixture.

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285. (new) In combination:

an aircraft comprising at least one aft swept wing, and a capture device mounted on an outboard leading edge of the wing, and

a fixture positionable in a flight path of the aircraft such that the fixture is inclined at an angle relative to the wing of the aircraft to permit the fixture to intercept the lead edge of the wing and to guide the fixture into connection with the capture device.

286. (new) A method of recovering an aircraft, the method comprising providing an aircraft having at least one aft swept wing, and a hook mounted on an outboard leading edge of the wing,

positioning a line in a flight path of the aircraft such that the line is inclined at an angle relative to the wing of the aircraft, and

causing the lead edge of the wing to intercept the line to guide the line into connection with the hook.

287. (new) The method of claim 286 wherein the lead edge of the wing of the aircraft is swept back at least fifteen degrees.

288. (new) The method of claim 286 wherein the line permits extended forward movement of the aircraft and reduces arrestment loads on the aircraft.

289. (new) A flying object comprising a spanwise lifting surface, a lateral deflecting structure attached to the spanwise lifting surface, the lateral deflecting structure having at least a 15 degree swept back or 20 degree swept forward angle, and a capture device adjacent the lateral deflecting structure, the capture device comprising a hook and a latch.

290. (new) The aerial recovery system of claim 253 wherein said structure is constructed to deflect said line laterally outboard.

291. (new) The aerial recovery system of claim 253 wherein said arrestment line is held up by a beam.

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